M82 - TILT AND WARP OF ITS PRINCIPAL PLANE

P. Notni, W. Bronkalla
Zentralinstitut für Astrophysik der AdW der DDR
Potsdam - Babelsberg

The main plane of a late type galaxy is best determined by its population I components : young stars, gas and dust. In the case of M82 the determination of its principal plane is complicated by its very irregular appearance and the presence of scattered light. We have used three-colour UBV-photometry of this galaxy to determine the stellar population, using the extinction- free parameter Q = (U-B) - 0.65(B-V), and the extinction A_B = 4 ((B-V) - $(B-V)_{oo}$; $(B-V)_{oo}$ being the intrinsic colour of the population, taken, e.g. from population synthesis calculations. Corrections for scattered light were made using the degree of polarization as well as the excess ultraviolet light (see Notni and Bronkalla, 1983 ; Notni et al., 1981 for details).

The southern half of the galaxy differs markedly from the northern one. Firstly, the bulk of the extinction is located south of the major axis (cf Fig. 1). The major axis has been drawn through the dynamical centre as given by Beck et al. (1978). Secondly, the stellar population of the smoother northern region differs from that of the more irregular southern region, as shown in Fig. 2. In the south, where the degree of polarization and hence the amount of scattered light is small, the Q = -0.3 line defines the beginning of the blue population I belt. In the north, this line signifies only the stronger contribution of scattered light and does not imply a population change.

We conclude from both figures : 1) The southern side of the principal plane is the near one (Lynds and Sandage, 1963, found the opposite, using the minimum in the H - distribution near the minor axis). The principal tilt, ϕ, can be crudely estimated from the axial ratio of an ellipse in the central regions : $10 < \phi \sim 12° < 20°$. 2) The plane is warped to the north,near the centre and west of it. The direction of this disturbance is in accord with the reaction of the dust to a mass of gas rotating about the major axis as deduced by Cottrell(1977). The existence of a simular disturbance of the plane defined by the stellar population I suggests, however, a more direct tidal influence as the main cause of the warp.

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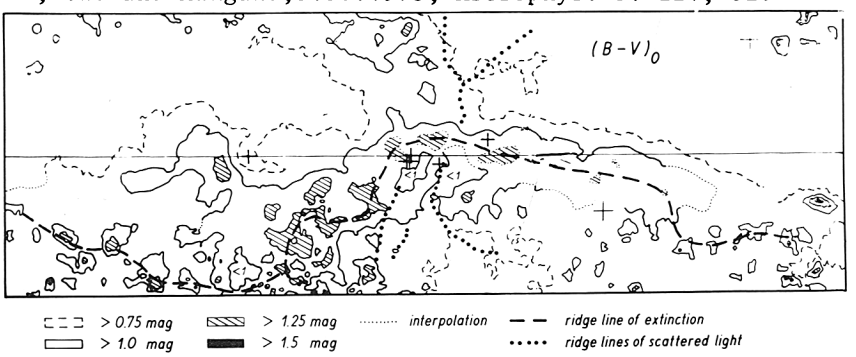

Fig.1. Plot of the colour index, $(B-V)_o$, in M82, corrected for scattered light. The size of the figure is 315" x "110", north is 25° left of vertical. Large crosses mark reference stars, small crosses the positions of features B,A (double), C and F (O'Connell and Mangano, 1978) and the dynamical centre (above A). To derive the colour excess, subtract 0.6 in regions with Q = 0 (north of Q =-0.05 line in Fig.2.), and subtract 0.2 in regions of pop. I (south of lower Q +-0.30 line in Fig.2.). The ridge line of the colour excess, defining the plane of the dust, lies mainly south of the major axis, and is warped to the north near the centre and west of it. Lines of maximum scattered light are also indicated ; some parts of the -0.75 isoline in the north have been omitted for clarity.

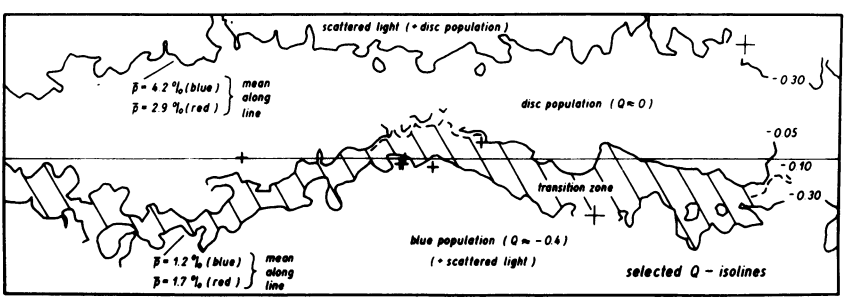

Fig.2. Plots of selectec isolines of the population index, Q, in M82, on the same scale as Fig.1. No corrections for scattered light have been made (increasing scattered light decreases Q). The transition zone between old disk population and young population can be seen, as well as the similarity in position between the blue population I belt (Q<-0.30) and the ridge line in extinction south of the major axis (compare Fig.1.). The southern extent of the pop. I belt cannot be determined because of the increasing scattered light contribution. Mean polarization values, approximately corrected for measuring errors, have been indicated (Bingham et al. 1976, Chesterman and Pallister, 1980).